

## TITLE

### BOLTED PILOT WEB WITH PRECISION MACHINED BEARING STOP

## FIELD OF THE INVENTION

5           The present invention relates to a bolted pilot web with a precision machined bearing stop.

## BACKGROUND OF THE INVENTION

A known bolted pilot web is found in US Patent No. 4,004,472. This patent  
10 describes a detachable bearing support secured to a housing by a series of bolts. The bearing support is made from cast iron to ensure that the inner bearing assembly does not work loose during operation of the differential unit. The bearing support is detachable in order to provide a method for mounting the drive pinion in the housing.

US Patent No. 6,544,140 provides a pinion mounting comprising a race attached  
15 to the casing of the differential gear mechanism by a plurality of bolts. The bolts are installed through a plurality of mounting holes in the radial flange of the race. The race is in constant contact with the casing, resulting in no gap therebetween.

The above-described designs have several disadvantages. Known heavy and single tandem axle designs include the integration of the pinion bearing cage into the  
20 carrier casting. Because of the relative shape and position of the pilot web relative to the remainder of the carrier assembly, casting the carrier as a single piece is more complex and not a cost effective casting process. Attempts at bolting the pilot web to the

remainder of the carrier assembly have resulted in unacceptable transference of forces,  
and the bolts coming loose under load.

## SUMMARY OF THE INVENTION

5       The present invention defines a pilot web and differential carrier assembly. A  
pilot web, with a first end and a second end, contains at least one aperture located at each  
of said first and second ends. A differential carrier comprises at least two apertures in  
complementary locations to said apertures of said pilot web. A first stop on the pilot web  
aligns with a second stop on the differential carrier. The second stop is disposed adjacent  
10 to, and aligned with, the first stop, with the first and second stops defining a gap  
therebetween. At least two bolts are disposed through the respective apertures of the  
pilot web and the differential carrier with bushings disposed about the at least two bolts.

## BRIEF DESCRIPTION OF THE DRAWINGS

15       The above, as well as other advantages of the present invention will become  
readily apparent to those skilled in the art from the following detailed description when  
considered in the light of the accompanying drawings in which:

Fig. 1 is an illustration of a known carrier and pilot web;

Fig. 2 is an exploded view of a pilot web and carrier assembly according to the  
20 present invention;

Fig. 3 is a partial view of an embodiment of the pilot web of the invention; and

Fig. 4 is an additional exploded view of the pilot web and carrier assembly of the  
present invention.

## DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

It is to be understood that the invention may assume various alternative orientations and step sequences, except where expressly specified to the contrary. It is also to be understood that the specific devices and processes illustrated in the attached drawings, and described in the following specification are simply exemplary embodiments of the inventive concepts defined in the appended claims. Hence, specific dimensions, directions or other physical characteristics relating to the embodiments disclosed are not to be considered as limiting, unless the claims expressly state otherwise.

Figure 1 illustrates a known carrier assembly 100 with integral pilot web 102. As is standard in the known art, the pilot web 102 is cast as a unitary piece with the carrier 100. Mounting bolts 104 are provided for mounting the carrier assembly.

Figure 2 illustrates a carrier assembly 10 and pilot web 12 according to the present invention. The pilot web of the present invention can be utilized to support the pilot bearing of the pinion that supports the ring gear of the differential. As illustrated, the carrier assembly 10 and pilot web 12 are formed as separate pieces. As shown in the illustrated embodiment of the present invention, preferably four mounting bolts 14 are provided to secure the pilot web to the carrier assembly. When four mounting bolts are used, they are disposed in pairs to mount the pilot web 12 to the carrier assembly 10. The mounting bolts 14 pass through holes 16 in the pilot web 12 and into holes 18 in the carrier assembly 10, to secure the pilot web 12 to the carrier assembly 10.

In service, loads of the pinion reacted through the pilot bearing can cause shear loads which can cause the mounting bolts 14 to loosen from the carrier assembly 10.

Therefore, as a feature of the present invention, it has been found that bushings 20 or  
dowel bushings are preferably disposed about either two or four of the mounting bolts 14.  
The bushings serve to lock the pilot web 12 into position with the carrier assembly 10 and  
to absorb a great deal of the lateral forces. This addresses the concerns regarding the  
5 shear forces and helps secure the assembly of the pilot web 12 to the carrier assembly 10  
under load. If there are two bushings 20 used, they would preferably be disposed about  
mounting bolts 14 on opposing corners, i.e. the left bolt of one of the top and bottom  
pairs, and then the right bolt of the other pair. It has been found that two bushings 20,  
disposed around bolts on opposing corners (one top and one bottom), are generally  
10 sufficient to overcome the shear forces.

While the current invention envisions the use of two bushings 16, it is also  
possible, within the scope of the present invention, to use four bushings 16, one for each  
mounting bolt 14. Preferably, the bushings are made of steel. It is also preferable for the  
holes 16 in the pilot web 12 and the holes 18 in the carrier assembly 10 to each be  
15 counter bored to accept the bushing.

Figure 3 illustrates a hole 16, in the pilot web 12 having a counter bore 26. As  
can be seen in this embodiment, there is only the necessity of one counter bore 26 in this  
end of the pilot web, as this figure illustrates an embodiment of the invention utilizing  
only two bushings 20. In an embodiment utilizing 4 bushings, each of the holes would  
20 advantageously be counter bored.

Figure 4 illustrates an embodiment of the present invention wherein the pilot web  
12 is again not shown attached to the carrier 10, but is instead shown in much closer  
proximity. The web 12 has a stop 22 which is positioned adjacent to a stop 24 projecting

from the carrier 10. Because there will tend to be deflections of the structure under load, with the stop 22 of the carrier deflecting towards the stop 24 of the web, these stops 22, 24 must be precision machined to a very high tolerance, to minimize the clearance therebetween. A minimal clearance between the stops 22, 24 is necessary for assembly.

5 Preferably, the stops are machined so that there is only about a few thousands of an inch clearance between them. Most preferably, the clearance is about 0.002" or less between the stops 22, 24. Clearance between the stops 22, 24 results in bearing reaction forces being transferred from the pilot web 12 into the carrier assembly 10, upon the gap being closed when under load. The minimal clearance between the stops 22, 24 results in the  
10 combination of stops essentially functioning as a single unit and maximizing the bearing forces transferred. The combination of precision machined gap between stops 22, 24 and the use of the bushings 20 described above provides component stiffness approaching that of a pilot web that is cast directly onto the carrier.

In accordance with the provisions of the patent statutes, the present invention has  
15 been described in what is considered to represent its preferred embodiments. However, it should be noted that the invention can be practiced otherwise than as specifically illustrated and described without departing from its spirit or scope.